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The Rise and Fall of Safeguard: Anti-Ballistic Missile Technology and the Nixon Administration

Abstract

The Safeguard Anti-Ballistic Missile system was the first (and up until 2002 the only) system deployed to defend the US from nuclear-armed ballistic missile attack. It was finally declared operational in September 1975 after many years of development and fierce controversy over both its feasibility and its desirability. However, almost immediately Congress voted to close the system down and it was dismantled within a few months. This paper draws on documents available in the Nixon archives to describe the complex intertwining of 'politics' and 'technology' that meant that a system that involved huge investment, and that had been portrayed as central to US defense policy, became apparently dispensable almost overnight.

Introduction

On September 28, 1975 the Safeguard anti-ballistic missile (ABM) system was declared fully operational.ⁱ Located close to Grand Forks, North Dakota, and designed to protect the nearby Minuteman intercontinental ballistic missile (ICBM) field, this site had originally been intended to be the first of several. As announced in March 1969, the full twelve-site system was to provide protection not just of US ICBM fields against Soviet ballistic missile attack, but also 'area defense' of the American population from the incipient Chinese missile threat or accidental missiles launches. However, almost immediately after being declared operational Congress voted to deactivate Safeguard, and it was withdrawn from service in February 1976.

Although there would be a resurgence in support for missile defense development under President Reagan, initiated by his famous 'Star Wars' speech of March 23, 1983, Safeguard stands alone as the only ballistic missile defense (BMD) system deployed to defend the United States until the Administration of G. W. Bush gave the go-ahead for the Ground-based Midcourse Defense (GMD) system in 2002. Surprisingly, however, the development and demise of the Safeguard system has been neglected by

historians even though many documents are now available in the Nixon archives.ⁱⁱ Other episodes in the history of US BMD development have received considerably more attention - both the ABM deliberations of Secretary of Defense Robert McNamara during the 1960s and the ambitious programme of research set in train by Reagan have attracted extensive literatures.ⁱⁱⁱ

What stands out about Safeguard is that a procurement programme that went reasonably smoothly in terms of budget and schedule culminated in a decision to deactivate the system almost immediately after it became operational.^{iv} The story of Safeguard thus appears to provide a compelling refutation of perspectives that see military technology as driven by the vested interests of a Military-Industrial Complex.^v The huge investments that were made in twenty years of ABM development did not result in overwhelming 'technological momentum'.^{vi} Nor did large technological accomplishments - material, epistemological, organisational, and political - result in 'lock-in'.^{vii}

This is significant because it is widely believed - amongst both supporters and opponents of weapons systems - that once deployment goes ahead, it becomes very difficult to reverse.^{viii} For example, Ralph Lapp argued that: 'Once an R&D project emerges from the conceptual stage and enters the development phase where big money is involved, then it tends to build up a momentum of its own.'^{ix} And in 1969, ABM opponent Adam Yarmolinsky expressed concern about the 'momentum of the ABM production line', arguing that 'once initiated, it would unleash powerful forces pressing towards elaboration and expansion'.^x

However, this fear proved unfounded, as Safeguard turned out to be the end of the ABM era, rather than the first step of a 'technological trajectory'.^{xi} To understand why this was so we need to uncover why it was that the technological edifice that Safeguard comprised was such a fragile

achievement. Why did a system that cost over \$30 billion^{xii} (in 2010 dollars) not develop ‘momentum’ or become ‘locked-in’?

The classic economic approach to understanding lock-in has focused on how increasing returns from investment result in a chosen technology being improved and thus gaining competitive advantage relative to competitors that did not receive the initial investment.^{xiii} Increasing adoption of a technology can also result in ‘network externalities’ that further entrench a technology because of societal investments in associated skills (e.g. expertise in using a QWERTY keyboard) or complementary assets (e.g. petrol stations for conventional automobile technology).^{xiv}

Donald MacKenzie’s sociological account of the development of inertial guidance technology shows that what appear to be technological trajectories are social constructs rather than natural phenomena.^{xv} Continued investment means that ‘success breeds success’ while alternative approaches are neglected and fail to make such improvements. However, as William Walker has noted, most large government projects (such as defense and infrastructure) differ from commercial technologies because of their dependence on government support, and because in many cases their limited production runs mean they benefit less from increasing returns.^{xvi}

Whereas commercial success is largely down to ‘the market’, success for government projects is mainly dependent on political and organisational commitment. Based on a case-study of the UK development of nuclear reprocessing, Walker argues that it is this commitment, and particularly the extent to which it is given ‘contractual’ permanence – either in commercial contracts or through other forms of difficult-to-break arrangements, such as international agreements – that determines how locked-in a technology becomes.^{xvii}

This paper will draw on archival material to describe how it was that the commitment to Safeguard– in the Nixon Administration and its supporters, in

the Congress, in industry, and in the military – that was apparently aligned in 1969, would so completely unravel by 1975. As will become clear, the central mystery here is not why Safeguard was cancelled, but how it was ever approved when even its supporters disagreed about its primary purpose, and so many arguments were being made against it, particularly with regard to its technical effectiveness. For this reason, this paper will focus on the key period (1969-1971) during which the Nixon Administration pressed for approval of Safeguard.

Background to the Safeguard Deployment

The launch of the Soviet Sputnik satellite in October 1957 was significant for US missile defense efforts in two main ways. First, the Army was given responsibility for ABM system development, despite the protestations of the Air Force.^{xviii} Second, the Advanced Research Projects Agency (ARPA) was set up to investigate state-of-the-art defense applications of science and technology, with a large part of its budget devoted to missile defense work in Project Defender. The first ABM system developed by the Army was the Nike Zeus three-stage missile armed with a nuclear warhead, along with associated radar, control, and communications systems to direct the missile towards the target reentry vehicle. From 1960 onwards the Army pressed for deployment with no success, despite enrolling support in Congress ‘to loose the Zeus’.^{xix}

However, Secretary of Defense Robert McNamara repeatedly rejected the Army’s requests for Zeus deployment, and in 1963 instead instigated the Nike-X programme. Nike-X involved two major advances over Zeus. First, Nike-X utilised a layered defense, with a longer range version of the Zeus missile (later to be known as Spartan) as the first line of defense, able to intercept warheads up to a 100 mile altitude. A second line of defense was provided by the high acceleration Sprint missile that was designed to intercept reentry vehicles within the atmosphere, by which time any decoys or other lightweight penetration aids would have been stripped away by

drag. The second significant advance of Nike-X was the use of phased array radars that had been developed by ARPA in Project Defender. Because they scanned electronically rather than mechanically, these radars were less vulnerable, and could handle many more targets, more rapidly.^{xx}

Further efforts by the Army to get ABM deployment approved were rebuffed for three reasons. First, McNamara was concerned that this would be technologically premature and that early deployment would result in wasteful obsolescence. Second, comparisons of the effects of various combinations of offense and defense on American casualties in a nuclear exchange suggested that investment in ballistic missile defenses would not be cost effective.^{xxi} Better value, in terms of American lives saved per dollar, could be achieved by enhancing the ability of US offensive weapons to penetrate Soviet defenses and by US civil defense efforts.^{xxii} Third, McNamara was concerned about the arms race implications of an offense-defense competition.^{xxiii}

McNamara was eventually over-ruled by President Johnson in 1967. Disillusioned with the state of the war in Vietnam and fearful of an 'ABM gap' being used against him in the 1968 presidential campaign, Johnson pushed McNamara towards a compromise.^{xxiv} The arguments of ABM supporters were also enhanced by the detonation of China's first H-bomb in June 1967, and by McNamara's failure to convince the Soviet Premier Kosygin that defensive systems should be limited to prevent an arms race.^{xxv} The result was McNamara's famous San Francisco speech of September 1967. The Chinese developments provided a rationale for McNamara to give some ground on ABM deployment – endorsing a limited system aimed at the potential Chinese threat – while resisting the major deployment geared towards the Soviet threat which he believed to be not only futile but also counterproductive.^{xxvi}

The resulting Sentinel ABM system was thus designed to handle a threat that when it eventually emerged was expected to comprise only a small number of technologically unsophisticated ICBMs.^{xxvii} Against this threat even a 'thin' ABM system might be effective, but such a system would not pose a significant threat to the much larger and more capable Soviet nuclear forces. Moreover, McNamara noted, in addition to defending against the Chinese, this thin ABM could have secondary benefits. First, it could be used to defend US Minuteman missile fields, thus adding to the ability of the US to guarantee assured destruction retaliation. Second, it could provide protection against any accidental launches of nuclear-armed ballistic missiles.

Of the fifteen areas chosen to be the locations of Sentinel installations, ten were major urban centres, one was in Alaska, and the other four were air force bases that housed US retaliatory forces. However, the location of many of these bases exacerbated the opposition to ABM technology. Along with those who argued that the technology would not work, or that it was strategically unwise, or both, other protesters now complained about the proximity of Sentinel to cities. Critics such as the Federation of American Scientists argued that Sentinel bases would be targets, thus drawing down fire on nearby cities, making them 'megaton magnets', and there was also concern that the nuclear warheads on ABM interceptors might explode accidentally or, in the case of launch, prematurely.^{xxviii}

Ironically, after years of pushing to deploy an ABM system (typically voting for funding that the Administration left unused), Congress now saw the emergence of a coordinated coalition against the ABM.^{xxix} Given this upsurge of opposition, it was not surprising that the Administration of Richard Nixon initiated a review of US strategic programmes on 20 January 1969, shortly after taking office. On 6 February 1969, the new Secretary of Defense, Melvin Laird, halted the Sentinel programme, pending completion of this review.^{xxx} According to Nixon's National Security Advisor, Henry Kissinger, this was done 'in order to pull the teeth of public criticism.'^{xxxi} Born in domestic

politics – as a political fix intended to counter the prospect of Republicans citing an ‘ABM-gap’ in the 1968 Presidential election - Sentinel thus also died due to domestic politics. However, both Nixon and Kissinger’s instincts ‘were against unilaterally giving up a weapons program’, and the ABM would be reborn in a different guise.^{xxxii}

The Safeguard Compromise

The new ABM approach, called Safeguard, was announced by Nixon on March 14, 1969. Safeguard was to encompass up to twelve sites, with initial Phase 1 construction of two sites to protect Minuteman fields at Air Force bases in Montana and North Dakota. Alongside this primary role of protecting US deterrent forces, the full Safeguard system was also intended to provide population defense against a light attack from China or against an accidental launch.

Four sites were to be located close to Minuteman fields and would use both the long-range Spartan interceptors as well as Sprints for terminal defense. Most of the other eight sites would only use Spartan interceptors, thus providing complete coverage of the United States, albeit only against a small threat. Moving defensive sites away from cities had a political logic, but it also chimed with those who believed that Minuteman defense was not only desirable, and also more feasible than population defense. For example, Harold Agnew, Weapons Division Leader at the Los Alamos National Laboratory argued that an ABM system ‘could add significantly to the survivability of our strategic missile forces, the command centers which control their use and the command structure’, pointing out that ‘technically hardpoint terminal defense is a much easier problem than that associated with area defense’.^{xxxiii}

However, the technical difference between Sentinel and Safeguard was slight^{xxxiv} and the overall rationale for Safeguard was as much an outcome of

politics as it was of coherent strategic thinking. As Time magazine noted at the time, Safeguard had 'both the virtues and defects of most compromises: it may fall short of either its political or military objective, but it has a fair chance of being accepted by Congress and may be politically tenable for a while'.^{xxxv} In particular, Safeguard was a compromise between those in the Administration who preferred Minuteman defense against the Soviet Union and those who favoured population defense against China or an accidental missile launch. President Nixon was keen to emphasize the potential for protecting the US people from missile attack, but the Department of Defense, and Secretary of Defense Laird were much more interested in defense of US retaliatory forces such as the Minuteman missiles.

Thus Kissinger wrote to President Nixon in early March 1969 that:

It is important to recognize that believers in at least two fundamentally different views have united behind the Modified Sentinel proposal. ... One view is that the Modified Sentinel deployment fills important gaps in the protection of our deterrent and provides options for meeting possible new threats to our deterrent that have not yet appeared, such as accurate Soviet MIRVs. Area protection of our population is a valuable by-product of this deployment, but no greater protection of our cities should be contemplated because this would stimulate a costly arms race, increase the instability in US-Soviet strategic relationships, and ultimately leave us no better off.^{xxxvi}

However, the other group supporting what would become Safeguard saw 'the deployment primarily as a useful first step toward obtaining a major damage limiting capability against the Soviet Union as well as a necessary step in maintaining an invulnerable deterrent. Holders of this view fully expect to propose additional deployments for the defense of cities later on unless arms control agreements make such deployments unnecessary.'^{xxxvii}

The Battle for Congressional Support

On 10 March Nixon was informed by one of his advisors, Bryce Harlow, that:

Careful analysis of the immediate situation in the Senate strongly indicates: 1) The ABM system advanced by LBJ has no chance whatsoever; 2) Even a modified system can now be passed only with maximum effort, including all-out Presidential participation. ... We estimate right now in the Senate the modified plan would lose by 58-42.^{xxxviii}

Given this analysis, there was debate within the Administration about what approach to adopt in the Congressional battle. Some were keen to use tough tactics, making full use of the resources of the government to attack opponents. A particular target of Administration hardliners was Senator Edward Kennedy, one of the most outspoken and publicity-friendly of the ABM opponents. Patrick Buchanan, one of the President's key advisors, wrote to Nixon suggesting that this approach 'would give us the ABM and it would throw Edward M. Kennedy into the posture of a naive young Senator who would leave America naked in a hostile world of powerful enemies.' Buchanan argued that '[i]n 1964 Candidate Goldwater had his feet cut out from under him by Secretary McNamara's selective release of confidential material relating to the American deterrent.' He continued: 'No campaign staff can compete with the Department of Defense – with its thousands of secrets tucked away. We now have that million-man research staff and files – and we ought to use it in this ABM battle with EMK.' Buchanan thus argued for the selective, well-timed release of information about Soviet and Chinese military forces:

Yes, it would scare the American people some perhaps. But it would give them the truth. ... What would Kennedy do? Get Jerome Wiesner to deny the facts the Department of Defense has put out? We've got the megaphone now; and we've got all the data – let's use it judiciously for our own purposes, just as they used it for theirs. ... We can not only win this fight; we can visit some permanent damage on our opponents for the future – if we let them climb out on that limb far enough – and then break it off. ... Wait until the crucial moment in the Senate debate, (even if we are going to win), and then have Laird unload on EMK and all his friends, and see how they come out of the hailstorm.^{xxxix}

However, others in the Administration, including Kissinger's military assistant General Al Haig, argued for a more moderate approach to ABM opponents. Haig expressed his concern that 'we are about to indulge in a campaign which is every bit as insidious as that of the opponents of the system and probably a great deal less sophisticated.'^{xl} He was particularly worried that a 'return to the middle ages approach ... will alienate a large segment of sophisticated Americans who, while conscious of the realities of the east-west problem, will be highly suspicious of the rhetoric of the early fifties.'^{xli}

To some extent the Congress could now be seen as representative of those 'sophisticated Americans'. Traditionally, Congressional hearings had relied on the DoD or other governmental experts to provide advice on weapons programmes. However, this changed on March 6, 1969 when outside scientists began a series of appearances before several committees of both the House and the Senate.^{xlii} Many of those testifying were critical of the plan to deploy Safeguard and the Administration sought to respond to this activity by seeking out supportive scientists.^{xliii} The Administration's perceptions on this matter can be seen in the title of a memo that Kissinger sent to Bryce

Harlow on 14 April, 1969. Although the memo contained what was described as ‘a list of additional scientists who probably favor the ABM,’ it was entitled “List of Scientists Who Have Unbiased Views on the ABM”.^{xliv}

ABM opponents largely shared the views that McNamara had held during his term in office, and indeed many of the leading opponents had either served in former Administrations or had been closely involved as advisors on ABM issues. These included all former Presidential Science Advisers (James Killian, George Kistiakowsky, Jerome Wiesner and Donald Hornig), some members of the President’s Science Advisory Committee (Sidney Drell, Wolfgang Panofsky, Marvin Goldberger), former ARPA Chief Scientist and Director of Defense Research & Engineering, Herbert York, former ARPA director Jack Ruina, and George Rathjens, also of ARPA.

The 1969 Congressional debates were detailed, confrontational, and at times highly personal.^{xlv} The closest the opponents came to stopping Safeguard was a key Senate vote on August 6 that resulted in a tied vote, with 50 senators for and 50 against, and the pro-ABM lobby only carrying the day due to the casting vote of the Vice-President Spiro Agnew.^{xlvi} This, however, was the highpoint of Congressional opposition to Safeguard, with other votes being carried more easily by its supporters.

Nixon himself took a very active role in lobbying for Safeguard, he ‘alternately cajoled and berated both supporters and opponents’, and even criticized some members of his own cabinet, among them Secretary of Defense Melvin Laird, for not ‘doing enough’ to promote Safeguard.^{xlvii} When he read that former astronaut and Democratic Senator John Glenn had called the ABM a ‘false hope’ because ‘no one knows if it works,’ Nixon asked sarcastically: ‘did he know the first space shot would absolutely work?’ However, Nixon was also very pragmatic about the lobbying process, telling his staff to ‘concentrate on those [senators] who are on the fence and only on those where we have a chance to win.’^{xlviii}

Congressional approval of Safeguard was thus a personal triumph for Nixon, and he had no doubt where most of the credit lay. On August 7, 1969 he sent a memo to Haldeman, Ehrlichman, and Kissinger, stressing his achievement (and referring to himself in the third person):

The ABM vote is a major victory and I want the three of you to discuss it with Harlow in terms of getting out the true story as to Presidential influence and the "Nixon Style" in dealing with the Congress. First get out the practical information as to what the count was (20-46 with the rest undecided) before RN made his television speech and what the final result was. Then point out that RN made the decision to tackle ABM head on against the advice of most of his major advisers, including particularly the State Department. His television broadcast turned the thing around and started us on the way up. ... Never in history has probably a President, individually and collectively talked to more Senators on an issue than in this case. ... Also in this connection, point out that the President was in constant charge of the PR aspects of the ABM fight and dictated memoranda to be used by the PR people about getting out the positive line and also watched the press closely to knock down anything in the way of intelligence reports or other things that might be harmful. ... particularly emphasize that the difference with the RN style and that of Johnson and Kennedy was that never was there any implication whatever of arm-twisting [sic], threats, etc.^{xlix}

Administration Divisions

The Congressional battle of 1969 resulted in approval of the Administration's Phase 1 plan to construct two sites – Grand Forks in North Dakota and

Malmstrom in Montana - both of which were to defend Minuteman fields. In late 1969 the Office of the Secretary of Defense (OSD) started 'conducting an intensive internal review of the ABM program to determine options as to how and when to proceed with additional construction'.¹ The tone of this review worried Laurence Lynn, one of Kissinger's NSC staffers, because he was felt that Director of Defense Research and Engineering John Foster 'did not seem to be particularly sensitive to the importance attached here to the area defense portion of the system, a point which I underlined heavily'.^{li}

Lynn's views mattered because of Kissinger's close relationship with Nixon - so close that the term 'Nixingerism' has been used to describe their approach to foreign affairs.^{lii} This meant that the NSC had an unusual level of influence within the Administration on a matter such as the ABM. Lynn's concern about area defense was that it would be 'this part of the system that is likely to fall through the cracks, particularly since it is the least popular with Congress and the part that draws the fire of the arms controllers.' His guess was 'that DOD will try to skimp as much as possible in their FY 71 budget request for Safeguard and propose to slip the program'. The intention would be, Lynn wrote to Kissinger on 23 October, that 'in a classic manner DOD may try to game the President into increasing the DOD budget by leaving "his" program [area defense] out of their request'.^{liii}

A couple of days later, another memo from Lynn to Kissinger stressed that: 'The President attaches great importance to the area defense portion of the program.' In particular, Lynn noted that 'maintenance of area defense against third countries and accidents is a Presidentially-approved criterion of strategic sufficiency (NSDM 16) and should be given priority'.^{liv}

The OSD's review of Safeguard was ready at the end of the year. Its basic recommendations were a restatement of the Phase 2 Safeguard deployment plan to '(a) Extend area defense against the Chinese Threat (b) Broaden the base for Minuteman defense (c) Begin to implement the defense against the

SLBM threat.’ The review argued that it ‘is clear that the threat against which Safeguard was configured last year has continued to grow. ... to implement Phase 1 only would not be adequate, and we therefore recommend proceeding with the first step of Phase 2 deployment.’^{lv}

This meant beginning deployment of two more sites – Whiteman (in the Minuteman fields near St Louis) and the Northwest site - along with ‘advanced preparation of three more sites – Northeast, Washington, DC, and Michigan/Ohio.’ The timetable proposed deployment of the full twelve sites by October 1977, providing ‘area defense of the entire United States against a Chinese or other Nth country attack and of most of the strategic bomber bases against attack by depressed trajectory SLBMs.’ In terms of population defense, it was estimated that ‘the system would be able to absorb about 100 warheads,’ and against ‘SLBM attack, the system could blunt the leading edge of the attack on the bomber fields and absorb about 20 to 30 warheads per Safeguard site’, thus providing ‘about 10 or more additional minutes for the protected alert bombers to escape to safety.’^{lvi}

In the meantime, Phase 1 deployment at Grand Forks and Malmstrom was primarily geared towards Minuteman defense. Along with the third site at Whiteman, due to be installed by July 1975, and fourth at Warren by April 1977, these four sites were to house 120 Spartan and 264 Sprint missiles. Against ‘the lower threat level of 1000 to 1400 arriving Soviet RV’s [reentry vehicles], 200 to 300 Minuteman would be expected to survive’; against ‘higher threat levels, say 2000 arriving RV’s, the Safeguard Phase 2 deployment would be overwhelmed, but would still absorb some 300 to 400 RV’s which would otherwise be usable against our cities.’^{lvii}

This calculation that Safeguard could be thus overwhelmed led OSD to recommend the ‘development and evaluation of new defense components optimized for “hard-point” defense.’ In particular, they saw a need for ‘an improved Sprint and a smaller and cheaper radar and computer system.’

Without such technical improvements, the review concluded, likely developments in the threat would undermine the future effectiveness of Safeguard: 'The two serious technical arguments against the system are Soviet ICBM force expansion to the point where they simply overwhelm the system and the advancement of Chinese technology to the point where area defense becomes very difficult.'^{lviii}

NSC staffer Lynn read much into the OSD's report and much to concern him. He was especially worried about the apparent lack of faith in the capability of the current ABM technology, but these doubts had, of course, ramifications for planning. If the technology was not expected to work very well, did it make sense to build more sites to defend Minuteman in addition to the two that were already underway? 'The main argument for doing so', Lynn noted, 'is that if a full four site Safeguard Minuteman defense is in danger of being overwhelmed, two sites could be overwhelmed that much easier. The best way to handle the threat we will probably face in the early to mid-1970s is simply to proliferate the defense system we can have the quickest.'^{lix}

On the other hand, Lynn suggested that there were arguments against that approach:

We do not yet have a good technical solution to land-based missile survivability. Let's not commit ourselves to any more of the Safeguard solution than we have to and in the meantime pursue alternatives on a priority basis. ... The full Safeguard deployment calls for about 900 interceptors and 19 radars. If we should want to enter into an agreement with the Soviets to limit ABM deployments to a thin third country defense oriented against China, we would probably prefer Washington, DC and Michigan/Ohio to Whiteman, and we might not want Whiteman at all. Why not proceed with these and preserve our flexibility later to choose more Minuteman defense or a twelve site area defense or both?^{lx}

Lynn was also concerned that 'DOD has presented only a loosely structured rationale for the full deployment', giving the impression that 'they clearly regard it as an interim solution'.^{lxi} It was obvious to him that the DoD was keen on 'hard-point' Minuteman defense and 'clearly wants to move smartly in this direction'. Lynn's view, however, was that 'the stronger we argue for priority development of advanced components, the more we furnish the opposition with an argument to stop present deployments until these new components are available.'^{lxii}

The apparent indifference of the DoD to the full Phase 2 deployment stemmed not just from concern over the effectiveness of Safeguard as a Minuteman defense, but also from doubts about the area defense role. The compromise that was Safeguard appeared in danger of unraveling. Lynn noted that:

This year it will be even more important than it was last that the decision be related to a coherent rationale, which is uniformly understood and adopted throughout the Government. ... It will no longer be possible to argue that the deployment definitely planned is essentially only "R&D at an operational site," with the ultimate purpose the one most congenial to the speaker and his audience. Further deployments – for more Minuteman protection and especially for some area defense – mean we are building a particular operational system for a particular purpose. We must be able to defend the system in those terms.^{lxiii}

Lynn mused as to whether commitment to the original deployment plan should come first: 'Should we announce our intention to proceed with the full twelve site, multi-purpose program and develop the rationale for it, or should we commit ourselves to a less ambitious area defense program tailored to a specific rationale?'^{lxiv} Again, however, there was a problem with the area defense role of Safeguard; that it was difficult to defend on the grounds of effectiveness: 'Critics can be expected to emphasize that the system affords essentially no protection to the population against a determined attack. The arguments why the area component is nonetheless diplomatically and strategically useful are subtle and easily misstated in dangerous ways.'^{lxv}

As it happened the divisions in the Administration could not be readily contained and became public in January 1970. Secretary of Defense Laird made his views clear when 'both in his formal press conference and in his planeside statement on Sunday', he 'focused on the threat to Minuteman and tended to downplay the area defense role of Safeguard.'^{lxvi} This was problematic because: 'The President is committed to an area defense component for Safeguard and three of the five sites to which we would be committed under the DOD-recommended plan are primarily for area defense.'^{lxvii} Nor did it help that 'Mr Laird's comment about the failure of the

Chinese threat to increase will not make it any easier to defend the area defense elements.^{lxviii}

Divisions within the Administration also affected the question that arose in early 1970 of 'how deeply the President's personal prestige is to be engaged on a specific ABM deployment plan this year.' Lynn informed Kissinger of his doubts about whether the DoD could be trusted to whole-heartedly support the Administration's ABM policy: 'My opinion is that very heavy commitment of the President's prestige has more risks this year than last because I have no confidence that DOD's defense and advocacy of the decision will be conducted with skill and wholehearted devotion.'^{lxix} Kissinger then reported to the president his concerns about that year's Congressional battle: 'I believe it is likely that we will have another bloody fight on the Hill. Whereas last year we took the opposition by surprise, this year they will be well prepared.'^{lxx}

Kissinger outlined the dilemma to Nixon, pointing out that 'with respect to the Minuteman defense mission, we may well be damned if we do and damned if we don't. ... If we continue to emphasize Minuteman defense, and if the technical arguments discussed above are valid, we will be denounced for proceeding with a virtually worthless system. ... If we don't add a further Minuteman site, and emphasize the area defense rationale, we will be criticized for inconsistency with DOD's arguments last year.'^{lxxi}

Kissinger's summary of Safeguard's effectiveness was bleak: 'We might face a Soviet capability to destroy most of the Minuteman force beginning about 1974, when neither the new hard point defense systems nor the alternative basing arrangements would be available. However, - and this is perhaps the most disturbing point of all - I gather it is the view of many technical people, including those in the Army agency responsible for ballistic missile defense, that the Safeguard units we could have ready by then would not make any appreciable difference in the number of Minuteman which would survive

such an attack. For example, having Safeguard Phase 1 is projected in one Army analysis as saving only 20 Minuteman against an all-out counterforce attack by both SS-9s and upgraded SS-11s.^{lxxii}

Technical Advice

The widely-held nature of such doubts about Safeguard's performance is one of the most startling things that emerges from the documents available in the Nixon archives. The Nixon Administration had not sought wider scientific advice on its decision to press ahead with the Safeguard programme (much to the annoyance of many opponents).^{lxxiii} Nixon's indifference to technical issues was evident when he dismissed the concerns of his Science Advisor, Lee DuBridge, who relayed PSAC's doubts when he told Nixon on March 11, 1969 that Safeguard 'can't really do the job'.^{lxxiv} However, a 5 March memo from Kissinger to Nixon made it clear that they understood the ABM's technical limitations: 'The Administration can make no claim that the system will be effective against other than surprise attacks on bombers, accidental attacks, or early Chinese attacks, and very limited attacks on Minuteman.'^{lxxv} These limited objectives were nevertheless considered sufficiently worthwhile when put alongside Nixon and Kissinger's desire to match Soviet military developments and certainly not to disarm unilaterally (as they saw it).

Nixon's determination to press ahead with Safeguard meant that PSAC's skeptical advice, that had been readily accepted by the Eisenhower and Kennedy Administrations, was no longer welcome. Instead, as noted earlier, many who had worked for previous Administrations, including some from PSAC, testified against Safeguard in the 1969 Congressional debates (and Nixon would eventually show his displeasure with PSAC by disbanding it in 1973^{lxxvi}). However, PSAC's analysis of Safeguard's weaknesses were not simply the result of its narrow scientific calculations or of (what some certainly saw as) its liberal analysis of the superpower arms race. Rather

PSAC's views were widely shared, and indeed informed, by many other key actors including the Army.

Despite this, paradoxically, it was possible for reviews of the programme – such as the FY1972 Safeguard Review – to report that ‘technical progress on Safeguard has been very good and there are no serious technical problems.’^{lxxvii} Each individual component of the Safeguard system – the Spartan and Sprint missiles, their nuclear warheads, the two large radar systems, and the associated software and communications – apparently performed satisfactorily in tests.^{lxxviii} However, few thought that these tests, and the design specifications that they were meant to confirm, adequately captured the requirements of a large-scale nuclear attack.

In particular, the challenges for area defense of the population were quite different from those for point defense of hardened targets such as Minuteman silos. Area defense relied almost entirely on the use of Spartan interceptors because the short-range Sprint could only protect a localized area. Using Sprint missiles to defend the major urban populations of the USA (estimated to be about 200 at the time^{lxxix}) would have been impractical because of the large numbers that would have been required.

The longer range Spartan had a much larger ‘footprint’, but because interception would take place outside the atmosphere there was the potential problem of decoys and chaff to contend with. Moreover, if the incoming warheads were targeted at urban areas there was much less potential for ‘preferential defense’ (ignoring reentry vehicles on trajectories not directed at high value targets). This latter tactic, and the possibility of using Sprint interceptors, meant that point defense was considered more achievable in principle. If defending a Minuteman field, reentry vehicles not aimed at silos could be ignored. Moreover, light-weight countermeasures would have been stripped away by atmospheric drag and so defense using Sprint did not need to discriminate between decoys and reentry vehicles.

However, both the Army and Bell Laboratories, the prime contractors for Safeguard, had doubts about Safeguard's effectiveness in defense of Minuteman. This was particularly problematic since that was the role of the first (and as it turned out, only) deployed Safeguard site. The Army's doubts were reported to Kissinger in January 1970 when it was noted that: 'What is both surprising and troubling is the view, apparently circulating in the Army Ballistic Missile Defense Agency, that the Safeguard system would not make a significant contribution to Minuteman defense even during the interim period, from, say 1974 to 1978, when the threat may be great but new systems, either defensive or offensive, won't be available.'^{lxxx}

These concerns had been highlighted in a study by the PSAC Strategic Military Panel, summarized by its chairman Sidney Drell in a December 23, 1969 letter to DuBridge. This was relayed to Kissinger in early January:

Whatever may be the substantive validity of the technical arguments, this paper - prepared almost exclusively on the basis of ABMDA briefings - suggests that the Army, in pushing its alternative hard point defense concepts, is vigorously poormouthing the Minuteman defense potential of Safeguard. If - or rather when - that fact leaks, it could significantly strengthen the opposition's arguments not only against expanding the system, but even against the Phase I decision.^{lxxxi}

The 1969 OSD review of Safeguard also did little to calm these concerns. NSC staffer Lynn worried that it 'could be interpreted as conceding three major points to the Safeguard opposition: - DOD now agrees that the Soviets could overwhelm the Safeguard defenses and destroy the Minuteman force; (I cannot yet confirm DOD's arithmetic, but I suspect that there are plausible assumptions under which a lot less than 2000 arriving Soviet RVs would destroy virtually all of the Minuteman force.) - DOD now agrees that Safeguard components are not the "optimum" way to defend Minuteman; -

DOD now agrees that the Safeguard Minuteman defense will be obsolete within three to four years after it is first deployed.^{'lxxxii} The prospects for area defense appeared no better:

The DOD paper also suggests that Chinese penetration aids could make area defense “very difficult” and that this possibility is a “serious technical argument against the system,” though DOD does not believe this will happen soon. DOD does not point out, however, that routine Soviet deployment of penetration aids on their ICBMs and SLBMs, which is a very real possibility because they are probably now testing them, would also make area defense “very difficult.” What then will become of our area defense?^{lxxxiii}

Similar views were also expressed to the President by Republican Senator John Sherman Cooper, who wrote: ‘My suggestions are based upon talks with scientists, not those who may be considered being anti your administration, but most notably those who support the development of an effective protection system for the US land based missiles, and also want to maintain a credible nuclear deterrent. Their general views are [that] Safeguard is not an effective weapon. An effective ABM system could be built, but redesign and reengineering including the deployment of many additional radars and interceptor missiles are needed.’^{lxxxiv}

Then in April 1970 Bell Laboratories warned the Nixon Administration about their concerns over the performance of the technology. That month Kissinger sent a memorandum to the President reporting that: ‘The Bell people maintained that while the system will meet the technical specifications set for it, it is their belief that its contribution to military missions will be very slight.’^{lxxxv} As the Bell comments make clear, the main concern was not about the performance of the technology relative to its specification, but rather that the system was poorly designed for its task. The problem was ‘not any

difficulty with the test program', but 'rather the technical argument being made in some quarters that the Safeguard components are not a very good way to defend Minuteman (or the National Command Authority, which is also, for these purposes, a "hard point").'^{lxxxvi}

In particular, there was the problem of Safeguard's reliance on one Missile Site Radar (MSR) at each site. In a memo to Kissinger, DuBridge reported that 'PSAC noted that the MSR radars which were taken over from the old Sentinel system, designed primarily for area defense, had important disadvantages when applied to the defense of Minuteman sites. ... These large radar systems are extremely vulnerable and if certain of them were destroyed during an initial enemy attack, a large segment of our Minuteman force would be left defenseless.'^{lxxxvii}

Reliance on just one MSR at each site could be justified in Sentinel because the primary goal was defense against a very small Chinese threat, but the shift in emphasis in Safeguard to defense of Minuteman against a Soviet attack raised concerns about radar vulnerability. The Army had realised that this was problematic and had pushed for each Safeguard site to have two MSRs, but this had been rejected. Using two MSRs would have had two main benefits. First, geographically separated MSRs would have provided two lines of sight, and would have thus reduced the potential for a single high altitude nuclear detonation to black-out an area of the sky. Second, the risk of a whole Safeguard site being rendered useless if the MSR was destroyed would be reduced since there would be at least one back-up.

It was clear that: 'To deal with really large threats to Minuteman, we should have a system which is less dependent on a few big radars.'^{lxxxviii} However, the Administration was already committed to, and building, a system that relied on the large MSR radar approach. Within the NSC it was thought that 'the DOD proposal for substantial program of R&D on new concepts for hard point defense is likely to be taken as reflecting lack of confidence in the

Safeguard components' usefulness for hard point defense.' Instead, the question was raised of whether 'these technical doubts' meant that they 'should de-emphasize the Minuteman defense role of Safeguard, either deferring any further deployments until the technical picture is clarified, or giving priority to sites for area defense.'^{lxxxix}

However, as deployment moved slowly, and Congressional approval of new sites even slower, it was clear that Minuteman defense was the only rationale that could be made for the time being. The Administration pushed ahead, and on January 30, 1970 Nixon announced the FY 71 plans for Safeguard.^{xc}

Safeguard expansion was to build on the original two sites with a further six. Of these, a site defending the Minuteman field at Whiteman AFB was to go ahead with construction, while the other five were scheduled for preliminary work.^{xc} One of these – at Warren AFB in Wyoming – was also to protect a Minuteman field, while the other four would provide population defense. However, one of these four – at Washington, DC – also had a special role as it would be intended to defend the National Command Authority (NCA). This would also prove a particularly tricky proposition, both for domestic political reasons, and also because of its role in the SALT negotiations.

Safeguard and SALT

By this time the SALT negotiations were underway - the first round of talks began in Helsinki on November 17, 1969. Leading the US delegation was Gerard Smith, the head of the US Arms Control and Disarmament Agency (ACDA). Following the first round of talks he made a plea - which the Administration ignored - 'that from the point of view of strategic arms control, it would be desirable to keep Safeguard Phase II in R&D status during FY-71.'^{xcii} In practice, however, Phase 2 remained under wraps because the Senate would not endorse much beyond Phase 1.

A second round of talks began on 16 April, 1970 when the US made what Kissinger later referred to a 'first-class blunder' by offering an option for limiting ABM systems to one NCA-orientated site for each side.^{xciii} This was a compromise position within the Administration and a demonstration of what Kissinger viewed as 'the extent to which parochial bureaucratic considerations can overwhelm substance'.^{xciv} The problem with this option was that it bore little relation to the system currently being deployed by the US. A Washington DC site geared towards NCA protection was in the Administration's plans, but no construction had begun, nor would it as the Senate refused to endorse the plan. Indeed the Administration itself was divided on the value of an NCA-defense, with two main reservations leading to dissent. First, there was concern 'that the debate may serve only to call attention to the vulnerability of our command and control long before a defense is operational'.^{xcv} Second, there were worries about political opposition, both from DC residents who feared the local deployment of interceptor missiles, and ironically from non-DC residents critical of giving special protection to politicians -resulting in 'protests, however irrational, against defending "politicians and generals but not ordinary people."' ^{xcvi} These concerns fed a general unease - expressed, for example, by Senator Jackson - that consideration of a NCA defense would introduce 'unnecessary complications into the debate.'^{xcvii}

The NCA option made sense in the context of SALT - as a mirror image of the Soviet Moscow ABM system it might simplify negotiations: 'From the SALT point of view, protection of Washington is the easiest of all possible US ABM deployment to defend because it corresponds more obviously to the system the Soviets have constructed around Moscow.'^{xcviii} However, it had little support within the NSC:

There are concerns over the value of an NCA defense and whether we ought to be building it at all.

- Against a large attack, the NCA defense would buy only a few minutes' time.
- An intentional attack could be undertaken by means other than by ICBMs, e.g. single aircraft, submarine-launched cruise missiles, clandestinely introduced weapons.
- While the NCA defends against accidents, an accidental ICBM launch against Washington appears to have a low probability of occurring.^{xcix}

However, the Soviet Union had promptly accepted the US offer to limit ABMs to just one NCA-defense, and the US delegation struggled to regain the initiative, and to link any agreement on limits on defensive systems to one on limits on offensive weapons. On August 4, 1970 the US put forward a new proposal on offensive systems coupled with a complete ban on ABM systems (although the NCA-only proposal was not withdrawn).^c Not surprisingly this led to difficulties with the talks, with the Soviet side arguing for a separate agreement on ABM systems along the lines that the US had proposed earlier. Although this approach had originally come from the US side, it had become increasingly untenable in the light of the unwillingness of the Senate to endorse a NCA-defense for Washington, DC. The Administration's ABM policy was now very confused, with procurement out of kilter with the negotiating stance. As Kissinger recalled: 'The Senate was being asked to proceed with construction of one additional ABM site and preliminary work on five others at the very moment our Vienna delegation was proposing to the Soviets either a total ABM ban or a system limited to Washington for which we had not even requested funds.'^{ci}

In January 1971 Kissinger summed up the situation by noting that: 'We are building an area defense which we can't have, justifying a missile defense which won't work and negotiating an NCA defense we don't want.'^{cii} These

contradictions were also noted in the summary of a National Security Council (NSC) discussion in preparation for the 1971 annual Safeguard review:

This year's review of our Safeguard systems presents us with unique problems. We find ourselves in the following unique position:

- We are building an area defense for which we may not be able to get Congressional approval. Moreover, we are prepared to give up this system in SALT.
- We are justifying before the Congress a defense of Minuteman which we find is not particularly effective in defending Minuteman
- We are negotiating in SALT an NCA [national command authority] defense for which there is dubious strategic justification.^{ciii}

In March 1971 Nixon sought to resolve this dilemma by proposing that an agreement could be based on the Soviets keeping their Moscow system while the US kept the Safeguard sites that Congress had so far approved. A presidential decision on March 11 affirmed the continuing development of a four-site Safeguard system with no NCA site, and directed that the SALT negotiating position be aligned with this.^{civ}

This also fitted better with US strategic doctrine. Secretary of Defense Laird had made the point in January 1971 that, in his view, there was 'a clear contradiction between the strategic sufficiency criteria of NSDM-16, and the SALT guidance of NSDM-74.' According to Laird, one of the requirements of NSDM-16 was 'that we give the Soviets no incentive to strike first in a crisis, and therefore require that we assure the survivability of our deterrent forces. The currently authorized 4-site SAFEGUARD system would perform this function.'^{cv}

However, Laird also noted that: 'The sufficiency criteria call for area defense of our population against Chinese or other small missile attack. This criterion can only be satisfied by deployment of the full 12-site SAFEGUARD (area defense).' This contradicted the SALT guidance in which 'NSDM-74 specifies our willingness to forego area defense of the country and any defense of our deterrent forces against Soviet missiles, if the Soviets will agree to limit ABM's to Moscow and Washington and to accept numerical limits on offensive systems.'^{cvi}

There was therefore a contradiction in the policies 'because the provisions of NSDM-74 allow improvements in the Soviet missile threat which could by the mid-1970's make Minuteman vulnerable, and because these provisions preclude our area defense without limiting the Chinese or other threats identified in NSDM-16.' Laird was clear where his preferences lay in sorting out this contradiction. He considered that: 'Abandoning area defense may be, on balance, a proper price to pay to achieve a strategically acceptable agreement with the Soviets.' On the other hand, he was convinced 'that we cannot tolerate a vulnerable Minuteman force. Therefore, I recommend that NSDM-74 be modified to make clear that the agreement described is an initial agreement which must be followed before the mid-70's by a further agreement which adequately fixes the vulnerability problem.'^{cvi}

However, although Laird supported the idea that the US should be allowed to keep four Safeguard sites in return for the Soviet retention of its one Moscow defense, this was met with incredulity by the US SALT delegation. It now appeared that the US had three concurrent ABM proposals, with the earlier offers of a complete ban or NCA-defense only still on the table. Gerard Smith later noted that 'the fix for our differing SALT and congressional ABM postures was to table yet a third ABM alternative consistent with what the Administration was trying to get the Congress to support, a four-site Safeguard deployment.'^{cvi}

In May 1971 the Soviets agreed to drop their insistence on NCA-only ABM systems, and also accepted the US insistence on linkage of offensive and defensive systems by agreeing to discuss the two simultaneously.^{cix} The problem now, however, was that Nixon's proposal would allow each side to keep the ABM system it currently had in development. For the Soviet Union, this was the Moscow system, while for the USA it was the four Safeguard sites at Minuteman ICBM fields that had so far been approved by Congress.

This was a suggestion that the Soviets considered 'manifestly inequitable'.^{cx} Further US proposals reduced the ratio to three ICBM field defenses to one NCA-defense, but were equally unacceptable to the Soviet side. Finally, the Soviet side made a proposal, that although initially rejected by the US Administration, would form the basis of the final agreement. Under this proposal each side could have one NCA defense and one ICBM defense. On this basis the ABM Treaty was signed on May 26, 1972. In 1974 a further protocol was agreed that limited each side to just one site, either NCA or ICBM defense, thus formalising the de facto situation. The Soviet kept its Moscow system and the USA kept the Safeguard site at Grand Forks, albeit not for long.

The successful ABM negotiations stopped any further Safeguard deployment and the end for the one deployed site came in the autumn of 1975. Secretary of Defense Schlesinger had already told Congress in February 1974 that Safeguard would only be operated at full capacity for a year, before being 'maintained on a less than full time basis'.^{cx} DoD testimony to the House Committee on Appropriations confirmed that Safeguard could be overwhelmed by a Soviet missile attack and on October 2, 1975 only a day after Safeguard had been declared operational, the House voted to deactivate the system.^{cxii} Further votes in the Senate in November confirmed the House vote, with the proviso that the Safeguard perimeter and acquisition radar could remain in operation.^{cxiii} Even committed ABM supporters found the expense hard to justify, given the doubts about effectiveness, along with the

realization that the ABM Treaty meant that Grand Forks would stand alone in the missile defense role. It could no longer be viewed as a building block for the future; rather it would become a monument to the past.^{cxiv}

Conclusion

Contrary to the fears of ABM opponents, the deployment of Safeguard did not result in unstoppable technological momentum, but rather the opposite. It marked the end rather than the beginning of ABM development. This case study thus shows that the 'vested interests' of what has been called the Military-Industrial-Complex are far from all-powerful. Safeguard's continuation depended on far more than just the support of the armed services and industry, and even their support was far from uniformly enthusiastic.

The war in Vietnam and the increased emphasis on conventional defense of Europe led to 'flagging interest in BMD' in the Army in the late 1960s.^{cxv} Even the Army Ballistic Missile Defense Agency was lukewarm about Safeguard because it did not consider that its technical design (originally intended for defense against a very light Chinese threat) was appropriate for defense against a large Soviet threat. Instead, ABMDA sought approval for a new approach, known as 'hard-site', to defend Minuteman missiles. The prime contractor of Safeguard – Bell Laboratories – became increasingly skeptical too. Not only did Bell Labs assess the operational effectiveness of Safeguard to be low, but they also made it clear that they had no future interest in ABM contracts.^{cxvi}

Despite the huge amount of effort and money that went into it, Safeguard did not become locked-in. Unlike Walker's case-study of UK nuclear reprocessing, the commitment of almost all the key actors was transitory, with no legal or contractual obligations proving a barrier to cancellation. The future of Safeguard thus depended on the coalition of interests that Nixon had assembled, and this proved remarkably fragile. In the end it was the

SALT agreement and ABM Treaty that would endure as the legacy of Safeguard rather than the technology itself.

Maybe this was Nixon's intention all along – that he wanted Safeguard as a 'bargaining chip' to pressure the Soviets to participate constructively in the SALT process.^{cxvii} This is what Nixon claims in his memoirs, and it also supported by the recollections of Wiesner who at a meeting just after the Safeguard announcement was told by Nixon that: 'I need the system as a bargaining chip with the Russians'.^{cxviii}

However, it does not seem to be the case that Nixon intended to negotiate Safeguard away entirely. Rather it appears (I have found no definitive evidence either way in the archives) that Nixon did not pursue Safeguard solely as a bargaining chip, but was also initially focussed on the strategic benefits that ABM deployment could provide, particular as regards population defence against China. Raymond Garthoff (who was a member of the Department of State delegation in SALT) claims that Nixon 'personally favoured ABM deployment and expected (mistakenly) that the Soviets too would want a nationwide thin deployment against China'.^{cxix}

Nor was a complete ABM ban considered a desirable goal by the Nixon Administration in terms of the military balance with the Soviet Union. Analysis of possible force structures carried out in preparation for SALT showed that a complete ABM ban did not appear to be in the USA's best interests, at least if judged narrowly according to what would happen in a nuclear war. Thus, Kissinger reported to Nixon on May 23, 1969 that 'an ABM ban would appear to be much more in the Soviet interest than ours. In fact, it is probably not in our interest.'^{cxx}

Moreover, had Nixon only viewed Safeguard as a bargaining chip then he would surely not have pushed population defense when this was likely to be

opposed not only by some within his Administration (who preferred the emphasis to be on Minuteman defense), but also by the 'arms controllers' in Congress who believed that such a deployment would only stimulate the Soviet Union to build more offensive weapons. Garthoff argues that Nixon's initial enthusiasm for Safeguard was tempered by the difficulty the Administration had in gaining Congressional approval:

The ABM debate of 1969 had a number of important consequences. First, it made President Nixon and his administration more fervent partisans of ABM deployment ... The debate also made clear, however, that the longer term prospect for sustaining political support for ABM deployment was not good, and thus made the ABM system something that Nixon was more ready to limit (and trade) in SALT.^{cxvi}

ABM supporters who had argued for deployment throughout the 1960s thus achieved a pyrrhic victory when they won Congressional approval of Safeguard in 1969. Rather than this being the start of a shift towards defensive systems, Safeguard would mark the end of an era. Although some R&D would continue on the use of nuclear-armed interceptors for defence of US ICBMs (it was one option considered as a solution to the perceived vulnerability of the new MX missile), this type of BMD technology was falling out of favour. Other developments in BMD technology – involving lasers, space-based systems, and homing hit-to-kill interceptors – appeared to offer the potential for a non-nuclear defence, and these would form the basis for the next major phase in BMD development, instigated in 1983 by President Reagan's 'Star Wars' speech. However, these developments took place in a political context in which the ABM Treaty encapsulated the belief that the mutual vulnerability of the superpowers to each other's nuclear arsenal, while perhaps undesirable, was nevertheless unavoidable.

It was only with the break up of the Soviet Union that the political mood shifted decisively back in favour of ballistic missile defense of the USA. Although technical feasibility continues to be disputed, the feared threat that might be posed by so-called 'rogue nations' such as Iran and North Korea is expected to be much smaller and less challenging than that previously posed by the Soviet Union. BMD technology has thus come to be seen as more effective not primarily through technical progress – though there has been significant progress – but rather because of a change in the nature of threat.

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- i Initial Operational Capability had been achieved on April 1, 1975. The full complement of 30 Spartan missiles and 70 Sprint missiles was installed by October 1, 1975.
 - ii Unless otherwise attributed, all the documents cited are from the Nixon archives and were viewed at the National Archives, College Park, Maryland. They were scheduled to move to the Nixon Presidential Library during 2010.
 - iii The most significant are Jayne, 'The ABM Debate'; Yanarella, The Missile Defense Controversy; Adams Ballistic Missile Defense; Halperin, 'The Decision to Deploy the ABM'; Fitzgerald, Way Out There in the Blue; Broad, Teller's War; and Hey, The Star Wars Enigma.
 - iv According to a contemporaneous report 'all performance specifications have been met or exceeded, and the North Dakota site is being completed on schedule.' See Wade, 'Safeguard'.
 - v For various perspectives, see Hartnung, 'Eisenhower's Warning'; Fallows, 'The Military-Industrial Complex'; and Brunton, 'An Historical Perspective on the future of the Military-Industrial Complex'.
 - vi An early, but not very theorized, exposition of this idea is Hughes, 'Technological Momentum in History'. See also Winner, Autonomous Technology.
 - vii Two excellent papers that describe 'lock-in' in the nuclear power industry are Winskel, 'Autonomy's End'; and Walker, 'Entrapment in Large Technology Systems'.
 - viii See, for example, Yarmolinsky, 'The Problem of Momentum' in Chayes and Wiesner (eds.), ABM, 144-49; and Gray and Bresler, 'Why Weapons Make Poor Bargaining Chips'.
 - ix Lapp, Arms Beyond Doubt, 7.
 - x Yarmolinsky, 'The Problem of Momentum', 146-47.
 - xi Dosi, 'Technological Paradigms and Technological Trajectories'.
 - xii Broad, 'The Nuclear Shield' gives a figure of \$25 billion adjusted for inflation to 2000 prices.
 - xiii Arthur, 'Competing Technologies'; David, 'Clio and the Economics of QWERTY'.
 - xiv The QWERTY case has been extensively discussed in the work of David. For a counter-argument, see Liebowitz and Margolis, 'The Fable of the Keys'. On lock-in of the automobile system, see Unruh, 'Understanding Carbon Lock-in'.
 - xv Donald MacKenzie, Inventing Accuracy.
 - xvi Walker, 'Entrapment in Large Technology Systems'.
 - xvii Ibid.
 - xviii Barber Associates, The Advanced Research Projects Agency, III-49; Adams, Ballistic Missile Defense, 27. Yanarella, The Missile Defense Controversy, chapter 2; Baucom, Origins of SDI, 11. See also York, Race to Oblivion, 214.
 - xix Congressman Daniel Flood, quoted in Yanarella, The Missile Defense Controversy, 62. The most complete account of ABM work is Bell Laboratories, ABM Research and Development at Bell Laboratories. See also Walker, Bernstein and Lang, Seize the High Ground, 42-43.
 - xx Yanarella, The Missile Defense Controversy, 90.
 - xxi This 'damage limiting study' was carried out during 1963-64 by General Glenn Kent, and released as 'A Summary Study of the Strategic Offensive and Defensive forces of the U.S. and the USSR' on September 8, 1964. See Kent, 'Looking Back', 122-124. Its basic conclusion was that 'if the United States strives to stay at the outcome where 70% of the population survives against a reactive Soviet threat, the United States must spend at least two billion dollars to limit damage for every one billion dollars the Soviets add to create damage.' Achieving a higher US survival rate of 90% gave a much more unfavourable ratio of six to one. See also Kaplan, The Wizards of Armageddon, 320-24.
 - xxii See Kaplan, The Wizards of Armageddon, 320-324; Adams, Ballistic Missile Defense, 108-10.
 - xxiii McNamara's concern about the arms race potential of ABMs is described in Clearwater, Johnson, McNamara and the Birth of Salt.
 - xxiv A Republican booklet produced in February 1967 was entitled 'The Missile Defense Question: Is LBJ Right?'. Cited in Yanarella, The Missile Defense Controversy, 125.
 - xxv Newhouse, War and Peace in the Nuclear Age, 205.

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- xxvi This is described in Yanarella. For a particularly caustic view of McNamara's reverse, see Wiesner, *ABM*, 299.
- xxvii Although it was a questionable assumption that the Chinese could develop long-range ballistic missiles but not then also develop decoys if faced with a US ABM system.
- xxviii Halsted, 'Lobbying Against the ABM, 1967-1970'; Yanarella, *The Missile Defense Controversy*, 146-147. For more detail on the protests, see Primack and von Hippel, *Advice and Dissent*.
- xxix Yanarella, *The Missile Defense Controversy*, 149-154.
- xxx Adams, *Ballistic Missile Defense*, 187-91.
- xxxi Kissinger, *The White House Years*, 205. His official title was Assistant to the President for National Security Affairs.
- xxxii Kissinger, *The White House Years*, 205.
- xxxiii H. M. Agnew, 'What's Wrong With Sentinel', January 2, 1969 paper quoted by Cahn, *American Scientists and the ABM*, 110-11.
- xxxiv One change was that as well as providing protection against Soviet ICBMs coming from the north, some radars were also be orientated towards the sea to enable defense against submarine-launched ballistic missile (SLBMs). See Kissinger, *The White House Years*, 207.
- xxxv 'The ABM: Not Really Settled', *TIME*, Friday, Mar. 21, 1969.
- xxxvi 'Issues Concerning ABM Deployment' attached to memorandum for the President from Henry A Kissinger, Subject: Modified Sentinel System, March 5, 1969, NSC Files, Box 843, Folder Sentinel ABM System Vol. 1 2/11/69 [Feb-Apr 69].
- xxxvii Ibid.
- xxxviii Memo for the President from Bryce Harlow on 'Congressional Status of ABM Issue', March 10, 1969. NSC Files, Box 843.
- xxxix Memorandum to the President from Patrick J Buchanan, March 19, 1969, 'EMK & ABM', NSC Files, Box 842, Folder Sentinel ABM System Vol. 1 2/11/69 [Feb-Apr 69].
- xl Memorandum for Henry A Kissinger from Al Haig, Subject: Clearance for Release of Three Papers, April 30, 1969, NSC Files, Box 844, Sentinel ABM System Vol II, 4/1/69. Alexander P. Butterfield's papers were 'ABM - A Weapon Against War', 'Six Facts you probably didn't know about Soviet Military Power' and 'Committee for the ABM and a Strong America' (a fund-raising letter).
- xli Ibid.
- xliv Cahn, 'American Scientists and the ABM: A Case Study in Controversy', 74; Yanarella, 155-57.
- xlvi In her survey of ABM scientists, Cahn found that of the 32 in her sample who testified before congressional committees, 20 were opposed and 12 were in favour. Cahn, 92.
- xlvii Memorandum for Bryce Harlow, from Henry A Kissinger, 'List of Scientists Who Have Unbiased Views on the ABM', April 14, 1969, NSC Files, Box 844, Second folder, 2 of 2.
- xlviii One confrontation between Albert Wohlstetter, who testified in the support of Safeguard, and several opponents, including Rathjens was especially bitter. Wohlstetter focused on errors made by Rathjens in the calculations concerning Minuteman vulnerability that he presented to Congress, going so far as to arrange a special investigation by the Operations Research Society of America (ORSA), even though neither Rathjens, nor any of the other opponents targeted by Wohlstetter were ORSA members. Accounts of this episode can be found in Doty, 'Can Investigations Improve Scientific Advice? The Case of the ABM', and Kaplan, *The Wizards of Armageddon*. The OSRA report was published in 'Guidelines for the Practice of Operations Research', *Operations Research*, Vol 19, No. 5, (September 1971), 1123-1258, with further reactions in *Operations Research*, Vol. 20, No. 1, 205-246.
- xlvi Baucom, *The Origins of SDI*, 50.
- xlvi Hoff-Wilson, "'Nixingerism,' NATO, and Détente,' 511.
- xlvi Ibid, 511-12.
- xlvi Memorandum for H. R. Haldeman, John Ehrlichman, Dr Kissinger from The President, August 7, 1969, NSC Files, Box 844, Folder 3 Sentinel ABM System, Vol III 6/1/69.

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- ⁱ Memorandum for Henry A Kissinger from Laurence E Lynn,, Jr, 'Current Status of ABM Program', October 23, 1969. NSC Files, Box 844, Folder 3 Sentinel ABM System, Vol III 6/1/69.
- ^{li} Ibid.
- ^{lii} Hoff-Wilson, "'Nixingerism". NATO, and Détente'. See also Kissinger, 805, where he describes how Nixon 'tended more and more to delegate the tactical management of foreign policy to me'.
- ^{liii} Memorandum for Henry A Kissinger from Laurence E Lynn,, Jr, 'Current Status of ABM Program', October 23, 1969. NSC Files, Box 844, Folder 3 Sentinel ABM System, Vol III 6/1/69.
- ^{liv} Memorandum for Henry A Kissinger from Laurence E Lynn,, Jr, 'Status of Safeguard ABM Program', October 25, 1969. Folder 3 Sentinel ABM System, NSC Files, Box 844, Vol III, 6/1/69.
- ^{lv} Memorandum on the Safeguard System, Office of the Secretary of Defense, 31 December 1969. NSC Files, Box 840, Folder ABM System 1/70 Vol III Memos and Misc, 2 of 2.
- ^{lvi} Ibid.
- ^{lvii} Ibid.
- ^{lviii} Ibid.
- ^{lix} Memorandum for Dr Kissinger, from Laurence E. Lynn, Subject: Department of Defense Proposal for Further Safeguard Deployment, January 5, 1970. Folder ABM System 1/70, NSC Files, Box 840, Vol III Memos and Misc, 2 of 2.
- ^{lx} Ibid.
- ^{lxi} Ibid.
- ^{lxii} Ibid.
- ^{lxiii} Ibid.
- ^{lxiv} Ibid.
- ^{lxv} Ibid.
- ^{lxvi} Memorandum for Dr Kissinger from Laurence E Lynn, Jr, "Safeguard FY 71 Decision", January 8, 1970. NSC Files, Box 840, ABM System 1/70 Vol III Memos and Misc, 1 of 2.
- ^{lxvii} Ibid.
- ^{lxviii} Ibid.
- ^{lxix} Ibid.
- ^{lxx} Memorandum for the President, From Henry A Kissinger, Subject: FY 71 Safeguard ABM Deployment Decision, enclosed with memo from Lynn to Kissinger, dated January 16, 1970. NSC Files, Box 840, ABM System 1/70 Vol III Memos and Misc, 1 of 2.
- ^{lxxi} Ibid.
- ^{lxxii} Ibid.
- ^{lxxiii} Wang, 289; Herken, 168-69.
- ^{lxxiv} Wang, 291.
- ^{lxxv} 'Issues Concerning ABM Deployment' attached to memorandum for the President from Henry A Kissinger, Subject: Modified Sentinel System, March 5, 1969, NSC Files, Box 843, Folder Sentinel ABM System Vol. 1 2/11/69 [Feb-Apr 69].
- ^{lxxvi} See Wang, 307.
- ^{lxxvii} FY 72 Safeguard Review. Box H-007 Nixon NSC Institutional Files, Verification Panel Meetings Safeguard 1/16/71.
- ^{lxxviii} The official history notes that a lesson of the Safeguard experience was that 'development of a large weapons system can be completed on schedule to prescribed performance specifications, with effectively controlled costs' and describes the Kwajalein flight tests as 'almost unbelievably successful.' Bell Laboratories, III-1 and III-2.

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- ^{lxxxix} Chayes and Wiesner (eds), ABM: An Evaluation of the Decision to Deploy an Antiballistic Missile, 26.
- ^{lxxx} Memorandum for Dr Kissinger from Laurence E. Lynn, January 13, 1970. Subject: FY 71 Safeguard ABM Deployment Decision, NSC Files, Box 840, ABM System 1/70 Vol III Memos and Misc, 1 of 2.
- ^{lxxxi} Memorandum for Dr Kissinger, from Laurence E. Lynn Jr, Subject: PSAC Strategic Military Panel Comments on Minuteman ABM Defense' January 5, 1970. NSC Files, Box 840, ABM System Vol. III. Available at the National Security Archive, 'Missile Defense Thirty Years Ago: Déjà vu All Over Again?', <http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB36/index.html>
- ^{lxxxii} Memorandum for Dr Kissinger, from Laurence E. Lynn, Subject: Department of Defense Proposal for Further Safeguard Deployment, January 5, 1970. Folder ABM System 1/70, NSC Files, Box 840, Vol III Memos and Misc, 2 of 2.
- ^{lxxxiii} Ibid.
- ^{lxxxiv} Letter from John Sherman Cooper to the President, Feb 11, 1970. NSC Files, Box 840, ABM System 1/70 Vol III Memos and Misc, 1 of 2.
- ^{lxxxv} Memorandum for the President from Henry Kissinger, Subject: Contractor Doubts about Safeguard, April 15, 1970. Available at the National Security Archive, Missile Defense Thirty Years Ago: Déjà Vu All Over Again? <http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB36/index.html>
- ^{lxxxvi} Talking Points for Dr Kissinger, NSC Meeting, January 23, 1970, Nixon NSC Institutional Files, National Security Council Meetings, Box H-026.
- ^{lxxxvii} Memorandum for Henry Kissinger from Lee A DuBridge, Science Advisor, 'Considerations Pertaining to the Safeguard System', January 21, 1970. Folder 3 Sentinel ABM System, Nixon NSC Files, Box 844, Vol III 6/1/69.
- ^{lxxxviii} Talking Points for Dr Kissinger, NSC Meeting, January 23, 1970, Nixon NSC Institutional Files, National Security Council Meetings, Box H-026.
- ^{lxxxix} Ibid.
- ^{xc} Cahn, 'American Scientists and the ABM: A Case Study in Controversy', at 65.
- ^{xc i} Kissinger recalls that the choice of Whiteman, another Minuteman defense site and thus doing little to add to population defense (it was near St. Louis and thus could play some such role) was purely down to politics: 'Nixon, convinced that nothing else would pass the Congress and preferring an illogical ABM development to none at all, oped for Laird's recommendation of Whiteman'. Kissinger, The White House Years, 539.
- ^{xc ii} Letter from Gerard Smith, US Arms Control and Disarmament Agency to the President, December 30, 1969. NSC Files, Box 840, Folder ABM System 1/70 Vol III Memos and Misc, 2 of 2.
- ^{xc iii} Kissinger, The White House Years, 542. Reflecting on this, Kissinger told Harold Brown on August 30, 1970 that: 'I often make mistakes, but usually I know why afterward.' Memo for Henry A. Kissinger from Peter W. Rodman, 'Memcon of your talk with Harold Brown', September 1, 1970. National Security Archives.
- ^{xc iv} Kissinger, The White House Years, 542. He notes that the DoD 'feared a complete ban on ABMs and therefore supported NCA because this would at least keep ABM technology alive' while 'State and ACDA preferred no ABM at all, but they accepted NCA because it was symmetrical with the program of the Soviet Union and therefore "negotiable"'.
- ^{xc v} Memo for Dr Kissinger, from Laurence E Lynn, Jr, 'Memo for President on ABM', February 6, 1970, Nixon NSC Institutional Files, National Security Council Meetings, Box H-026.
- ^{xc vi} Ibid.
- ^{xc vii} Ibid.
- ^{xc viii} Memorandum for Dr Kissinger, from Laurence E. Lynn, Subject: Department of Defense Proposal for Further Safeguard Deployment, January 5, 1970. Folder ABM System 1/70, NSC Files, Box 840, Vol III Memos and Misc, 2 of 2, page 8.
- ^{xc ix} HAK Talking Points, Safeguard Review, NSC Meeting, January 27, 1971 attached to Memo for Dr. Kissinger from K. Wayne Smith, Subject: Talking Points on Safeguard, January 21, 1971. NSC Files, Box 842, Vol VI.
- ^c Smith, Doubletalk, 151.

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- ci Kissinger, The White House Years, 550-51.
- cii 'Verification Panel Meeting', January 16, 1971. National Security Archive.
- ciii HAK Talking Points, Safeguard Review, NSC Meeting, January 27, 1971 attached to Memo for Dr. Kissinger from K. Wayne Smith, Subject: Talking Points on Safeguard, January 21, 1971, page 1. NSC Files, Box 842, Vol VI.
- civ Kissinger, The White House Years, 813.
- cv Memorandum for the President from Secretary of Defense Laird, 27 Jan 1971, Nixon NSC Institutional Files, National Security Council Meetings, Box H-030.
- cvi Ibid.
- cvi Ibid.
- cvi Ibid.
- cvi Smith, Doubletalk, 211.
- cix Kissinger, The White House Years, 818-19.
- cx Smith, Doubletalk, 216.
- cx Schlesinger, Report to Congress, 1974, 123.
- cxii Baucom, The Origins of SDI, 96.
- cxiii Ibid, 97.
- cxiv The large, distinctive pyramid-shaped Missile Site Radar remains a highly visible reminder of Safeguard.
- cxv Yanarella, The Missile Defense Controversy, 132.
- cxvi Thus Kissinger wrote to Nixon on 15 April 1970 that: 'It has been known for some time that Bell Telephone Labs, the principal contractor for the Safeguard system, wanted to get out of the ABM business once Safeguard Phase 2 was finished.' Memorandum for the President from Henry Kissinger, Subject: Contractor Doubts about Safeguard, April 15, 1970. NSC Files, Box 841, Vol. IV.
- cxvii For example, Melvin Small, *The Presidency of Richard Nixon*, (University Press of Kansas, 1999), 102 says that: 'Although the president could not publicly reveal his strategy, he was unenthusiastic about developing ABM systems, given their cost and dubious effectiveness against the latest generation of missiles. But he wanted to be able to use Safeguard as a bargaining chip in SALT.
- cxviii Jerry Wiesner: Scientist, Statesman, Humanist - Memories and Memoirs (edited by Walter A. Rosenblith), MIT Press, 2003. pp 293-326, at 310. ' Nixon's own account also stresses the bargaining chip rationale for Safeguard, but of course this was written after the event. See Nixon, 416.
- cxix Garthoff, SALT I, 6.
- cx Memorandum for the President, from Henry A. Kissinger, May 23, 1969, NSC Files, SALT, Box 873, Vol 1, 1 of 2.
- cxii Raymond L. Garthoff, Détente and Confrontation (Transaction Publishers, 1994), 150. A similar analysis is provided by Bernard Brodie, 'On the Objectives of Arms Control,' *International Security*, Vol. 1, No. 1 (Summer 1976), 35. See also Robert J Bresler and Robert C. Gray, 'The Bargaining Chip and SALT', *Political Science Quarterly*, Vol. 92, No. 1 (Spring 1977), 65-88.